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Sediment Chemical Assessment of the Cornwall Canal, St. Lawrence River, Ontario

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Sediment Chemical Assessment of the Cornwall Canal, St. Lawrence River, Ontario

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FOREWORD

Since 1970 there have been several sediment surveys in the St. Lawrence River along the Cornwall waterfront to delineate the extent of sediment contamination and to associate these contaminants with local point sources. These surveys identified mercury contaminated sediment extending downstream from Domtar Fine Paper Ltd. and ICI Forest Products (formerly called CIL), and adjacent to, and downstream of the former Courtaulds Fibres Canada property (Richman and Dreier 2001).

Work undertaken as part of the Cornwall Sediment Strategy (sampling of perch from along the Cornwall waterfront and methyl-mercury modeling), suggested the potential existence of a fugitive source(s) of methyl-mercury. As a follow-up to this issue, a project titled "Cornwall Mercury Trackdown", was initiated to determine whether a fugitive source of mercury exists and to identify and take appropriate abatement action if required. Accordingly, this project was put forward to determine whether the Cornwall Canal is a source of mercury to the Cornwall waterfront. The data from this report will be integrated with additional information generated by related studies in the St. Lawrence River to track down potential local sources of mercury.

This report has been prepared under the auspices of the Canada-Ontario Great Lakes Remedial Action Plan Program. Financial support for the sampling projects, data analysis and report writing was provided by the Ontario Ministry of Environment (MOE) and Environment Canada. The track-down of Hg sources to the Cornwall waterfront is a multi-agency project coordinated by MOE's Eastern Region, with involvement from the City of Cornwall, The Raisin River Conservation Authority, Environment Canada, St Lawrence River Institute of Environmental Sciences (SLRIES) and MOE (Environmental Monitoring and Reporting Branch).

For additional technical reports or information on the St. Lawrence River Remedial Action Plan (RAP), contact the Ontario Ministry of Environment at 133 Dalton Road, Kingston Ontario, K7L 4X6.

ACKNOWLEDGMENTS

The author would like to acknowledge the assistance and time commitment of Duncan Boyd and Conrad Debarros of the Ministry of Environment (MOE) for their review of the report.

The author would like to acknowledge John Kraft from EC for providing equipment and a survey vessel and John Thibeau for assistance with the sample collection.

Laboratory sample analyses were performed by MOE Laboratory Services Branch. A subset of sediment samples were submitted to Flett Research Ltd. Laboratory in Winnipeg, Manitoba for methyl and total mercury analysis.

This study was funded in part by EC and MOE under the terms of the Canada-Ontario Agreement respecting Great Lakes Basin Ecosystems.

SUMMARY

The St. Lawrence River near Cornwall, Ontario was designated as a Great Lakes Area of Concern (AOC) in 1985 by the International Joint Commission in part because of contaminated sediment located along the north shore of the Cornwall waterfront. Sediment surveys along the waterfront since 1970 showed sediment concentrations greater than the "severe effect level" (SEL) of the Ontario Sediment Quality Guidelines for mercury extending downstream from Domtar Fine Paper Ltd. (herein referred to as Domtar) and ICI Forest Products (formerly called CIL). Sediment downstream of the former Courtaulds Fibres Canada facility (herein referred to as Courtaulds) had concentrations greater than the SEL for mercury, lead, copper and zinc (Richman and Dreier 2001). As such, a Remedial Action Plan (RAP) to improve the local conditions of the aquatic environment identified the need to address the issue of sediment contamination along the Cornwall waterfront (Dreier *et al.* 1997).

Work undertaken as part of the Cornwall Sediment Strategy (sampling of perch from along the Cornwall waterfront and methyl-mercury modelling), suggested the potential existence of a fugitive source(s) of methyl-mercury. As a follow-up to this issue, a project titled "Cornwall Mercury Trackdown" was initiated to determine whether a source of mercury exists and to identify and take appropriate abatement action if required. To support this project the MOE Environmental Monitoring and Reporting Branch collected sediment from the Cornwall Canal. To date, there was relatively little information on the sediment quality of the canal.

The objectives of the 2004 sediment survey were as follows:

(1) assess total and methyl mercury concentrations in sediment and determine whether the canal was a significant source of mercury to the Cornwall waterfront.

(2) determine if concentrations of various metals and trace organics in sediment located in the canal exceed the Provincial Sediment Quality Guidelines "severe effect level" (SEL) and "lowest effect level" (LEL).

Surface sediment (top 3 cm) was collected from 18 stations (arranged along 7 transects) using a stainless steel mini ponar (Figure 1). At one station along each transect a core sample was collected (using a hand-held benthos-sized corer). Sediment samples were analysed for trace metals including methyl mercury, organochlorinated pesticides, total PCBs (polychlorinated biphenyls), PAHs (polycyclic aromatic hydrocarbons), % TOC (total organic carbon) and particle size.

CONCLUSIONS

With the exception of one station, the data on methyl and total mercury (Hg) in sediment suggested that the canal sediments are not highly contaminated and are, therefore, not likely to be a significant source of Hg to the St. Lawrence River, particularly when

compared to sediment data collected from sites downstream of historical discharges. Total mercury concentrations in surface sediment were low and typically below the LEL (0.2 ug/g) at most stations. Higher concentrations of total and methyl Hg were present in sediment collected from the lower segment of the canal when compared with the upper segment, and the data suggested some Hg enrichment relative to local background condition. However, concentrations of total Hg were all less than the SEL. At one station in the lower segment of the canal methyl Hg was low in the surface sample and similar in concentration to other samples in the survey, but the more elevated concentrations within the core suggested increased mercury methylation with sediment depth. This station, located just downstream of an outfall which may have been associated with Domtar, also had sediment concentrations of nickel (Ni), copper (Cu) and iron (Fe) that were greater than the SEL within the deeper core segments and the highest concentration of total PCBs compared with other stations in the survey.

In general, throughout the canal, sediment concentrations of TOC and metals (with the exception of Transect 1 and manganese), were above the LEL. Cu, Fe and Ni concentrations were greater than the SEL in only one core sample (described above). In general, concentrations of Cu, Hg and Ni tended to be higher in the lower segment of the canal when compared with the upper segment of the canal. Pb, Cu and Zn concentrations were higher at several stations throughout the canal than concentrations along the Cornwall waterfront that were considered to represent local background conditions. Nevertheless, these values were well below the SEL and likely not problematic for biota living in or on the sediment.

TOC concentrations in more than half the sediment samples collected at, and downstream of, Transect 3, were greater than the SEL (100 mg/g) which indicated highly organic sediment. The highest concentration (470 mg/g) was present at Transect 4 which was located immediately downstream of an outfall that has been identified as a storm sewer which collects runoff from the surrounding area (L. Chalmers, personal communication).

Total PCBs were present in almost all sediment samples at concentrations greater than the LEL (0.07 ug/g). The maximum concentration was 550 ng/g present in sediment from the lower segment of the canal. Concentrations of total PAHs in sediment were typically greater than the LEL (4 *u*g/g) at most stations. The SEL was not exceeded in any samples for PAHs. The highest concentrations were present in the surface samples (top 3 cm) compared with the core samples which suggested an increase in recent PAH contamination.

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INTRODUCTION

The St. Lawrence River near Cornwall, Ontario was designated as a Great Lakes Area of Concern (AOC) in 1985 by the International Joint Commission in part because of mercury (Hg) contaminated sediment. As such, a Remedial Action Plan (RAP) to improve the local conditions of the aquatic environment identified the need to address the issue of sediment contamination along the Cornwall waterfront (Dreier *et al.* 1997) and a sediment management plan was developed.

Since 1970 there have been several sediment surveys in the St. Lawrence River along the Cornwall waterfront to delineate the extent of sediment contamination and to associate these contaminants with local point sources. These surveys identified mercury contaminated sediment extending downstream from Domtar Fine Paper Ltd. (herein referred to as Domtar) and ICI Forest Products (formerly called CIL), and adjacent to, and downstream of the former Courtaulds Fibres Canada property (Richman and Dreier 2001). Sediment samples collected in both these areas since 1970 exceeded the "severe effect level" (SEL) of the Ontario Sediment Quality Guidelines for mercury and sediment collected downstream of Courtaulds also exceeded the SEL for lead (Pb), copper (Cu) and zinc (Zn). Work undertaken as part of the Cornwall Sediment Strategy (sampling of perch from along the Cornwall waterfront and methyl-mercury modelling), suggested the potential existence of a fugitive source(s) of methyl-mercury. As a follow-up to this issue, a project titled "Cornwall Mercury Trackdown" was initiated to determine whether a source of mercury exists and to identify and take appropriate abatement action if required. This project was coordinated on behalf of Environment Canada and the Ontario Ministry of Environment by MOE's Eastern Region.

A number of potential sources were sampled and tested for methyl-mercury and trace level total mercury as part of the Cornwall Mercury Trackdown study. These potential sources included: City of Cornwall Storm Sewers – sampling of wet and dry flow events and combined sewer overflow (CSO) events; effluent discharges from Domtar and the City of Cornwall STP - sampled on a quarterly basis; ground water – all monitoring wells located on the properties of ICI and Domtar were sampled; storm water runoff – ICI will be conducting an evaluation of the quality of storm water runoff from their decommissioned property; and soil – soil samples from the snow dump area in Cornwall will be collected from several locations.

To support this project the MOE Environmental Monitoring and Reporting Branch collected sediment from the Cornwall Canal. Historically, there have been industrial and municipal discharges and spills to the canal. Presently, the only outfalls that are known to be active are believed to be storm sewers located along the north side of canal. To date, the chemical characterization of the sediment in the canal was unknown.

The overall objective of the 2004 sediment survey was to characterize the chemical composition of the sediment (surface and at depth) collected from the Cornwall Canal. More specific objectives were to:

(1) *assess total and methyl Hg concentrations in sediment and determine whether the canal was a significant source of mercury to the Cornwall waterfront.*

(2) *determine if concentrations of various metals and trace organics in sediment located in the canal exceed the Provincial Sediment Quality Guidelines "severe effect level" (SEL) and "lowest effect level" (LEL).*

Sediment was collected jointly by MOE and Environment Canada (EC) from 18 stations in July, 2004, and samples were analysed for a range of contaminants and physical parameters.

METHODOLOGY

Sampling Stations and Field Methods

Seven transects were identified along the length of the canal beginning at the west end (Figure 1). Typically, three stations were sampled across each transect with the exception of two transects located in the lower part of the canal where only one or two stations were sampled (Figure 2). With only one exception (Transect 6A), a surface sample was collected at all stations along a transect. In addition, one of the three stations was selected for the collection of a core sample. At Transect 6A, only a core sample was collected.

Sediment Collection for Contaminant Analysis

Sediment was collected using a stainless steel mini ponar from 18 stations. A portion of the upper 3 cm of at least 3 grabs (or more if required) were pooled and homogenized for each sample. Sediment was composited in a clean hexane-rinsed glass or ceramic bowl and thoroughly homogenized with a clean hexane-rinsed stainless steel spatula.

Single cores were collected from one station along the transect using a hand-held benthos-sized corer (inside diameter of 67 mm). Cores were sectioned every 10 cm where sufficient material was present. Only the top and bottom 10 cm sections were submitted for analysis. The remaining sections were archived.

All samples were placed in pre-cleaned glass jars with Teflon cap liners and stored in coolers on ice until submission to the laboratory for analysis

Water temperature, DO and conductivity were measured during sediment collection using a handheld system - YSI Model 85, which was calibrated daily.

Figure 1: Location of Transects and Sampling Stations in the Cornwall Canal, 2004

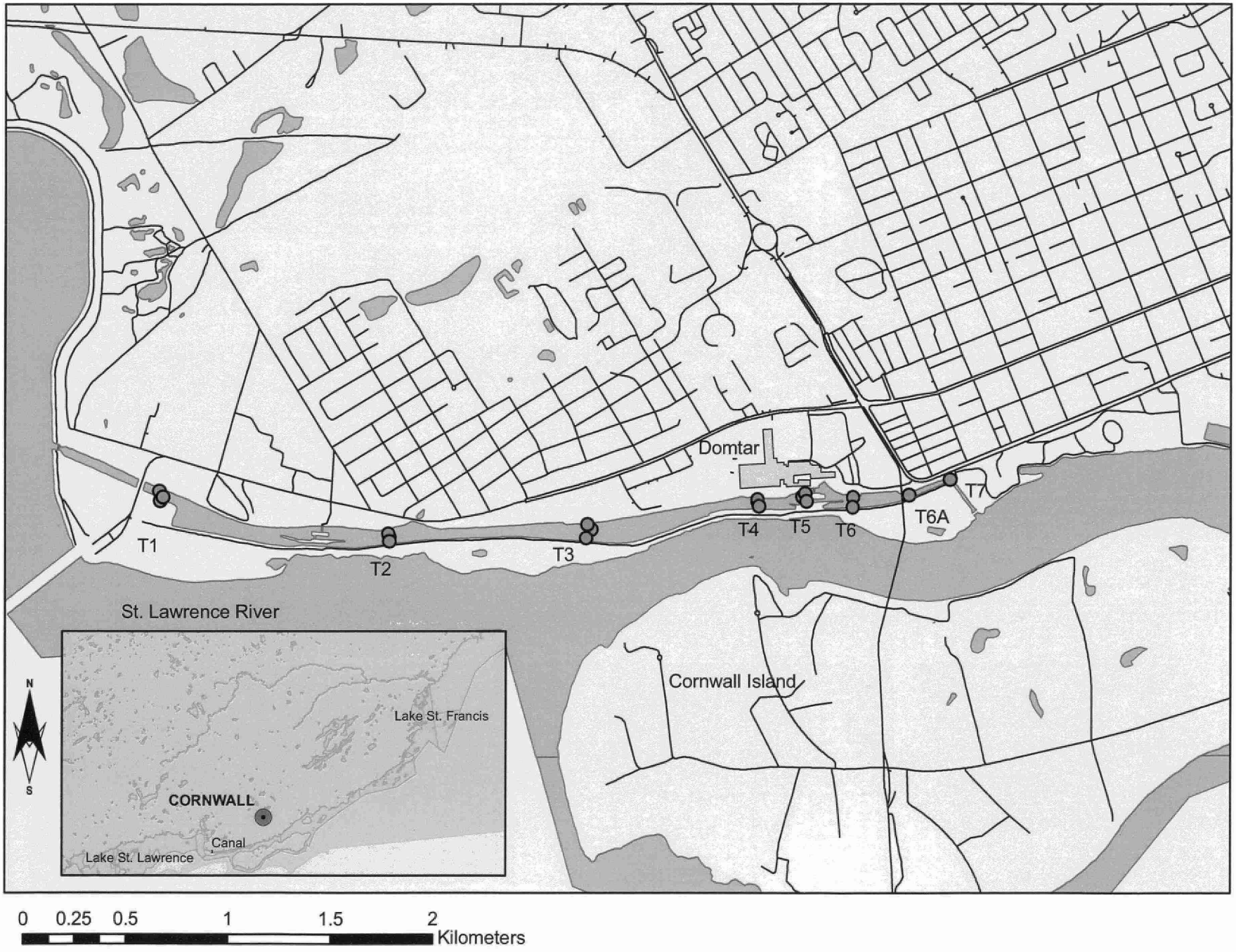
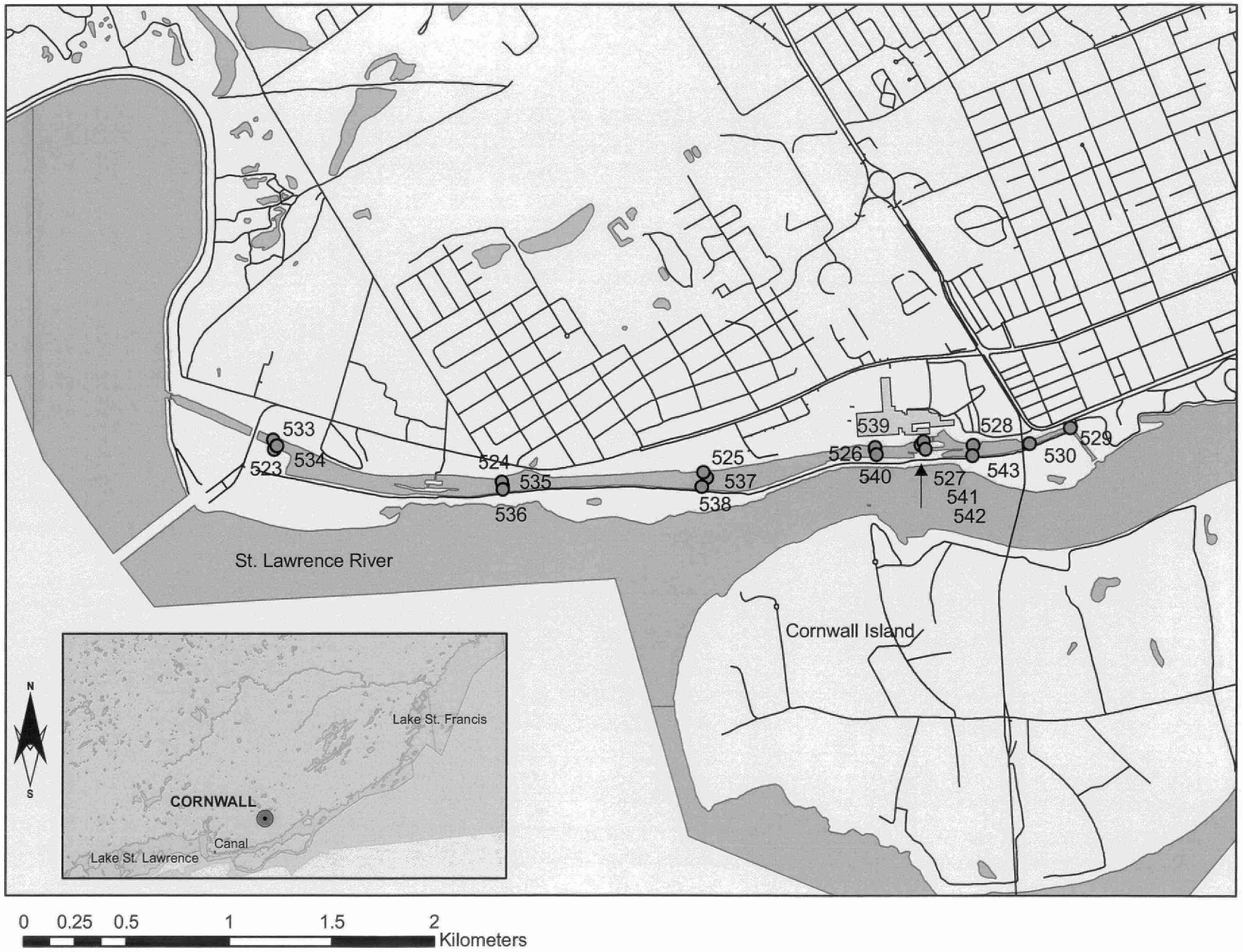


Figure 2: Location of Sampling Stations in the Cornwall Canal, 2004



Sample Submission for Contaminant Analysis

All samples were submitted to the Rexdale Laboratory for analysis. Samples were submitted for trace metals, organochlorinated pesticides, polychlorinated biphenyls (total PCBs), chlorinated benzenes, polycyclic aromatic hydrocarbons (PAHs), percent total organic carbon (% TOC), loss on ignition (LOI) and particle size. Methods for contaminant analysis are provided in MOEE 1989a &b; 2000; 2004.

In addition to the submission of samples to the MOE Rexdale Laboratory, a sub-sample from one surface sample from each transect and a sub-sample from the core samples (top and bottom 10 cm) were submitted to Flett Research Ltd.,440 DeSalaberry Ave, Winnipeg, Manitoba, R2L 0Y7 (204 667-2505) for total and methyl Hg analysis.

Data Analysis

Identification of Contaminated Sediment

Sediment contaminant concentrations were compared with the Provincial Sediment Quality Guidelines (Persaud *et al.* 1992). These guidelines describe three "effect" levels for different contaminants in terms of potential effects on the benthic community: (1) the no observed effect level; (2) the lowest effect level (LEL) which is the level of sediment contamination that can be tolerated by the majority of benthic organisms (concentrations greater than this level indicate that the benthic communities in these areas may be impaired); and (3) the severe effect level (SEL) which is the sediment concentration of a compound that is expected to be detrimental to the majority of benthic species. Sediment contaminant concentrations may exceed the LEL and/or the SEL with no apparent impact on the benthic community, nevertheless these guidelines serve as a point of reference to investigate the extent of sediment contamination within the study area and to compare the relative contamination with other locations.

Particle Size Correction Method

Trace elements tend to accumulate and bind to the clay/silt sediment fraction represented by particle sizes of less than 63 μm (Forstner and Wittmann 1983; Krumgalz *et al.* 1992). Consequently, the heterogenous nature of sediment makes it necessary to adjust trace element concentrations for the different particle size distributions at the various sampling stations in order to compare contaminant concentrations between stations if the effect of depositional environments are to be diminished, and trace metal contaminant sources are to be inferred. There are several methods frequently used to correct for depositional environments and hence particle size differences between stations (Forstner and Wittmann 1983; Krumgalz *et al.* 1992).

The approach taken in this report was to normalize the metal concentrations at all stations to a fine particle (<63 μm) content of 67% (Appendix B). This involved the multiplication of the contaminant concentration at a site by 67% and then dividing by the actual percent silt plus clay for the station. This percentage (67%) was chosen since it was the median value for the particle

size distribution for all samples collected in the study area. Another commonly used option would have been to normalize the concentration of contaminants to a fine particle content of 100% however, this method has a tendency to produce inordinately high metal concentrations at stations high in sand.

RESULTS AND DISCUSSION

Patterns of Sediment Contamination

Data for sediment contaminant concentrations and particle size for stations sampled in the Cornwall Canal were summarized in Tables A1 to A3. These tables are located in the Appendix of this report.

Mercury and Methyl Mercury

Total mercury (Hg) concentrations in surface sediment were low and typically below the LEL at all stations between Transects 1 to 5 (Table A1; Figure 3). A comparison of the data for samples analysed by both the MOE and Flett laboratories showed that concentrations were similar, however, the Flett data were in general, higher than the MOE data (Table A1). With only one exception (Hg greater than the LEL at Transect 5 using Flett data), this difference did not change the patterns of distribution of Hg within the study area. Concentrations were greater than the LEL in the deeper core segments from the station in Transect 4 and 5 and in the lower canal at Transect 6, 6A and 7 using both datasets. Hg concentrations increased with depth in the sediment core samples at some stations. Sediment did not exceed the SEL for total Hg throughout the study area.

With the exception of the core segments collected from Transects 4, 5, 6 and 6A, total Hg concentrations in the surface (top 3 cm) and top 10 cm of sediment were within the range measured for sediment samples collected from sites located upstream of the Moses Saunders Dam in Lake St. Lawrence. These sites were identified as reference stations in a report by Grapentine *et al.* (2003) which compared total and methyl Hg concentrations in sediment collected from areas impacted by local industries in Cornwall known to have historically discharged Hg to the river. This suggests that the sediment in the upper segment of the canal are not enriched with Hg. Sediment in the lower segment of the canal had total Hg concentrations similar to some sites located along the Cornwall waterfront which suggests some Hg enrichment relative to local background concentrations. When the data were compared to an earlier study of the Cornwall waterfront (Richman 1999), sediment concentrations in the lower segment of the canal were higher than concentrations in sediment considered to be un-impacted by local industry but lower than sediment collected downstream of the historical Hg dischargers (Appendix C). Since the highest concentrations in the canal are located near an outfall that appears to be associated with Domtar (Transect 6), this could be a potential source. However, the discharge

Figure 3: Total Mercury (ug/g) in Surface Sediment Collected From the Cornwall Canal, 2004

history of the outfall is presently unknown. Sediment collected from this station also had the highest concentrations of methyl Hg, Ni and Cu (i.e. greater than the SEL), and total PCBs relative to the other stations in the survey.

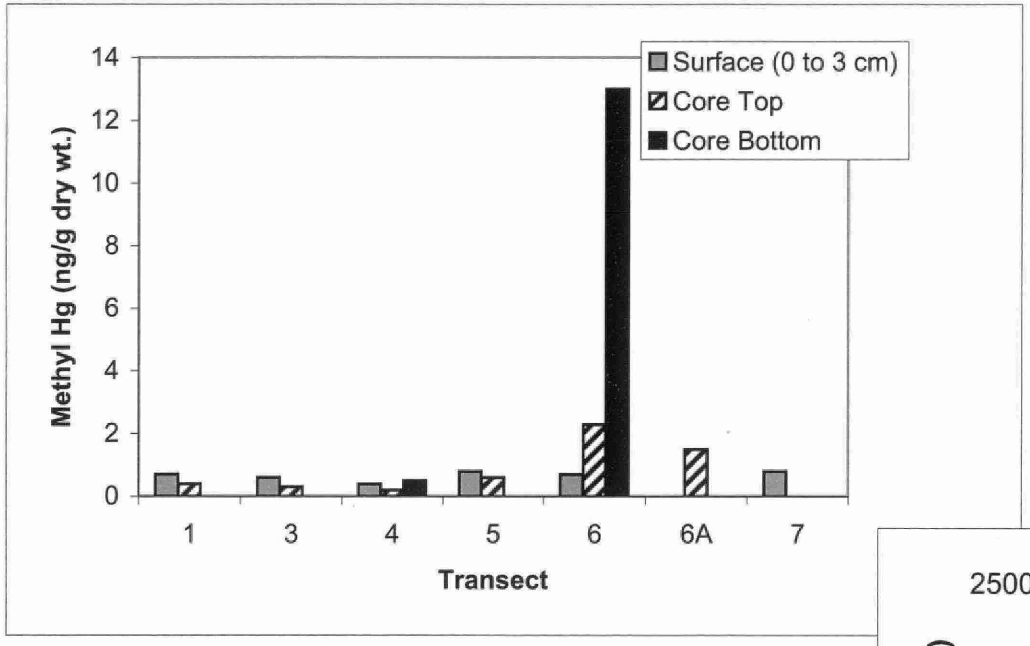
Methyl Hg concentrations in sediment followed a similar pattern to total Hg in general (the highest concentrations were present in the core segment of Transect 4 and 5 and in the lower canal at Transects 6, 6A and 7) (Figure 4). Methyl Hg concentrations in the surface samples were higher than in the core samples in Transects 1 to 5 while concentrations increased with core depth at Transect 6. The methyl Hg concentration in the bottom of the core collected from Transect 6 was an anomaly at 13 ng/g compared to all the other samples in the study which ranged from (0.2 to 2.3 ng/g) (Table A1; Figure 4). This value was confirmed by Flett Laboratory. However, it is unclear why the methyl Hg concentrations increased relative to the other samples in the survey or even within the core. It could possibly be connected to the higher silt content of that sample (70%) compared with the surface sample and other core segment (53% and 56% respectively), but TOC concentrations were similar throughout the core at that station. Interestingly, this segment of the core had the highest Fe concentrations (> SEL) which would suggest that the inorganic Hg would be more tightly bound and less available for methylation rather than the opposite result.

Sediment methyl and total Hg were positively correlated when the methyl Hg outlier was removed from the analysis (r^2= 0.52) (Figure 5). Inclusion of the sample produced an r^2= 0.01.

With the exception of the core segments collected from Transect 6 and 6A, methyl Hg concentrations in the surface (top 3 cm) and top 10 cm of sediment were within the range measured for sediment samples collected from the reference sites located upstream of the Moses Saunders Dam in Lake St. Lawrence (Grapentine *et al.* 2003). The percent methyl Hg was low in all samples. With the exception of two samples, the data showed that between 0.05 % to 0.53 % of the total Hg was present as methyl Hg. Surface sediment collected from Transect 1 had 2.6 % methyl Hg and the sediment from the bottom of the core from Transect 6 had 3.0 % methyl Hg. These ranges in percent methyl Hg were very typical of the data collected by Grapentine *et al.* (2003) from both exposed and reference sites.

Overall, the methyl and total Hg sediment data suggested that the although the lower canal sediment were enriched with Hg relative to local background conditions, they were not highly contaminated and were, therefore, not likely to be a significant source of Hg to the St. Lawrence River, particularly when compared to sediment data collected from sites downstream of historical discharges. The concentration range of both total and methyl Hg in sediment collected from the Cornwall waterfront in past surveys were higher than the concentrations measured in the canal in 2004, with the exception of the methyl Hg data from the core segments at Transect 6 and 6A (Richman and Dreier 2001; Grapentine *et al.* 2003).

Figure 4: Total and Methyl Mercury Concentrations (ng/g dry wt.) in Surface and Core Sediment Samples (analysed by Flett Laboratory)



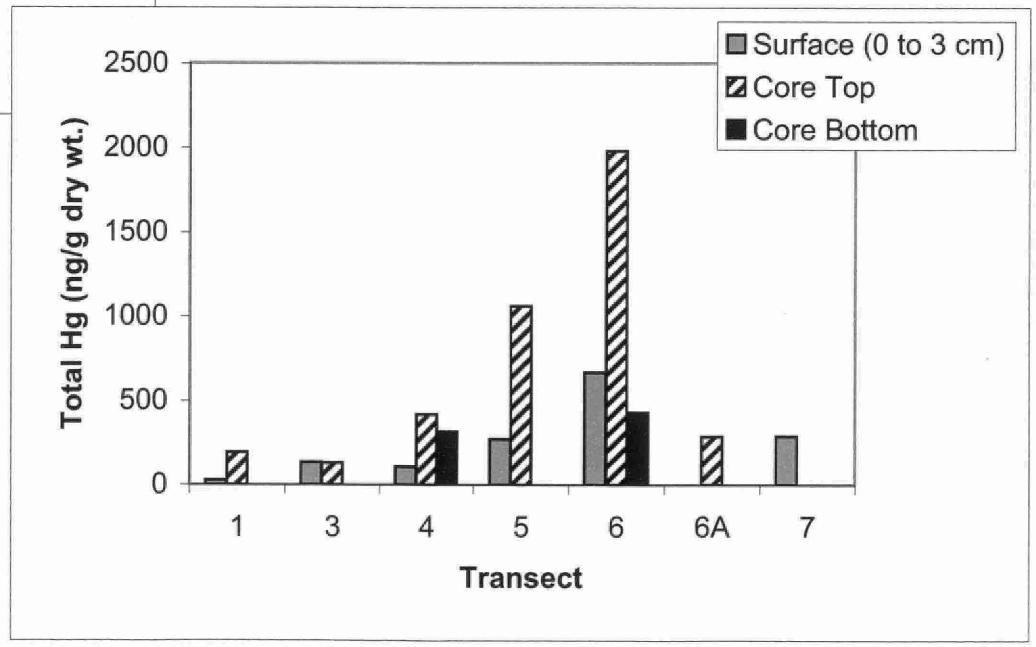
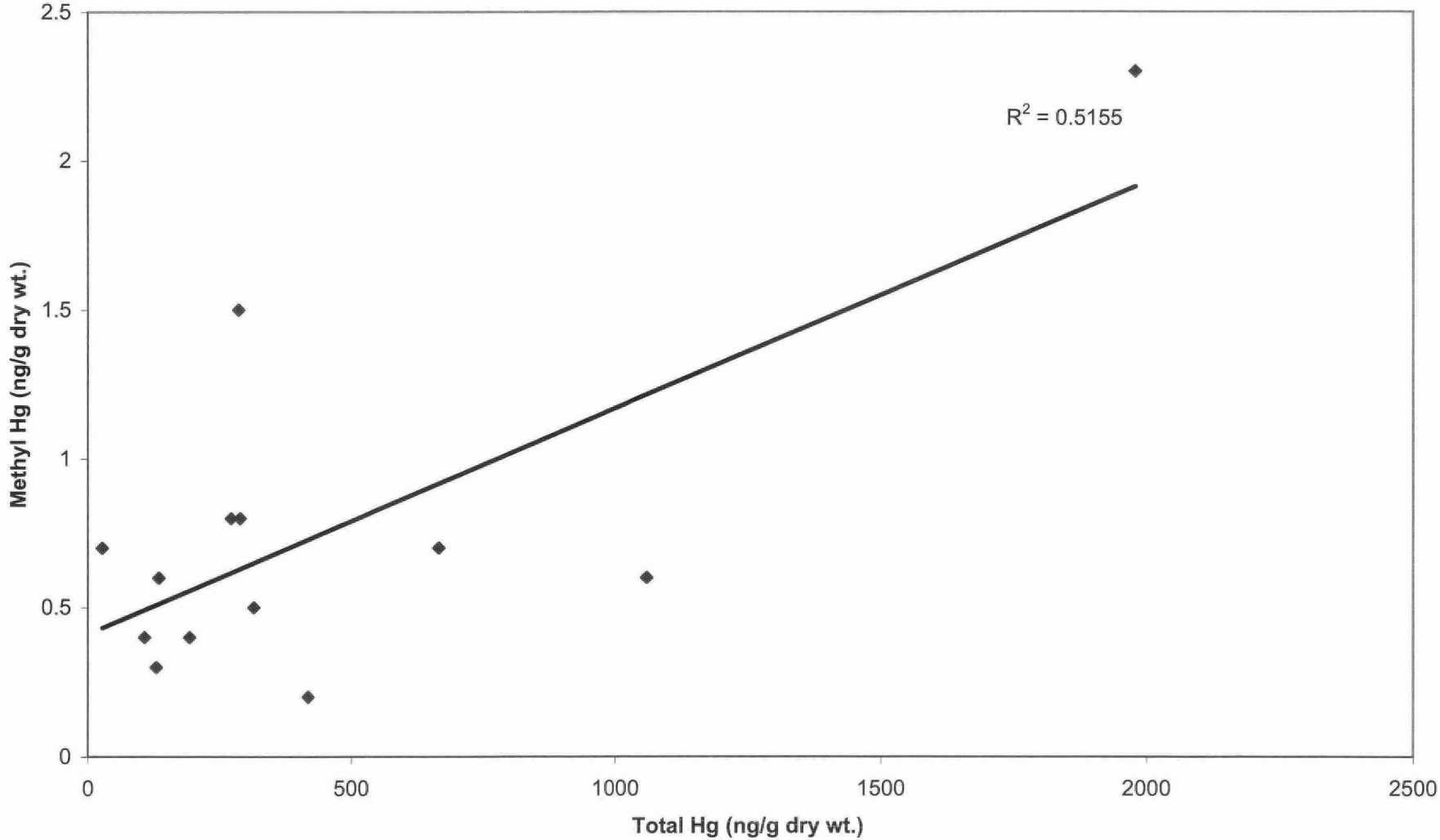


Figure 5: Sediment Methyl Mercury Concentrations vs Total Mercury Concentrations (minus core bottom sample (13 ng/g) from stn 528)



Metals

In general, throughout the study area, sediment concentrations of TOC and metals (with the exception of Transect 1 and manganese), were above the LEL (Table A1). Concentrations of metals were particularly low in sediment collected from Transect 1 due to the high sand content, and manganese concentrations in general were low at all stations. Concentrations of Cu, Fe and Ni were only greater than the SEL in the core sample collected from one station in Transect 6 where the highest Hg concentrations were detected (Figure 1). In general, however, concentrations of Cu, Hg and Ni tended to be higher in the lower part of the canal (at Transect 6 and 6A) when compared with the first (upper) segment of the canal. This pattern was confirmed when the data were normalized for particle size differences.

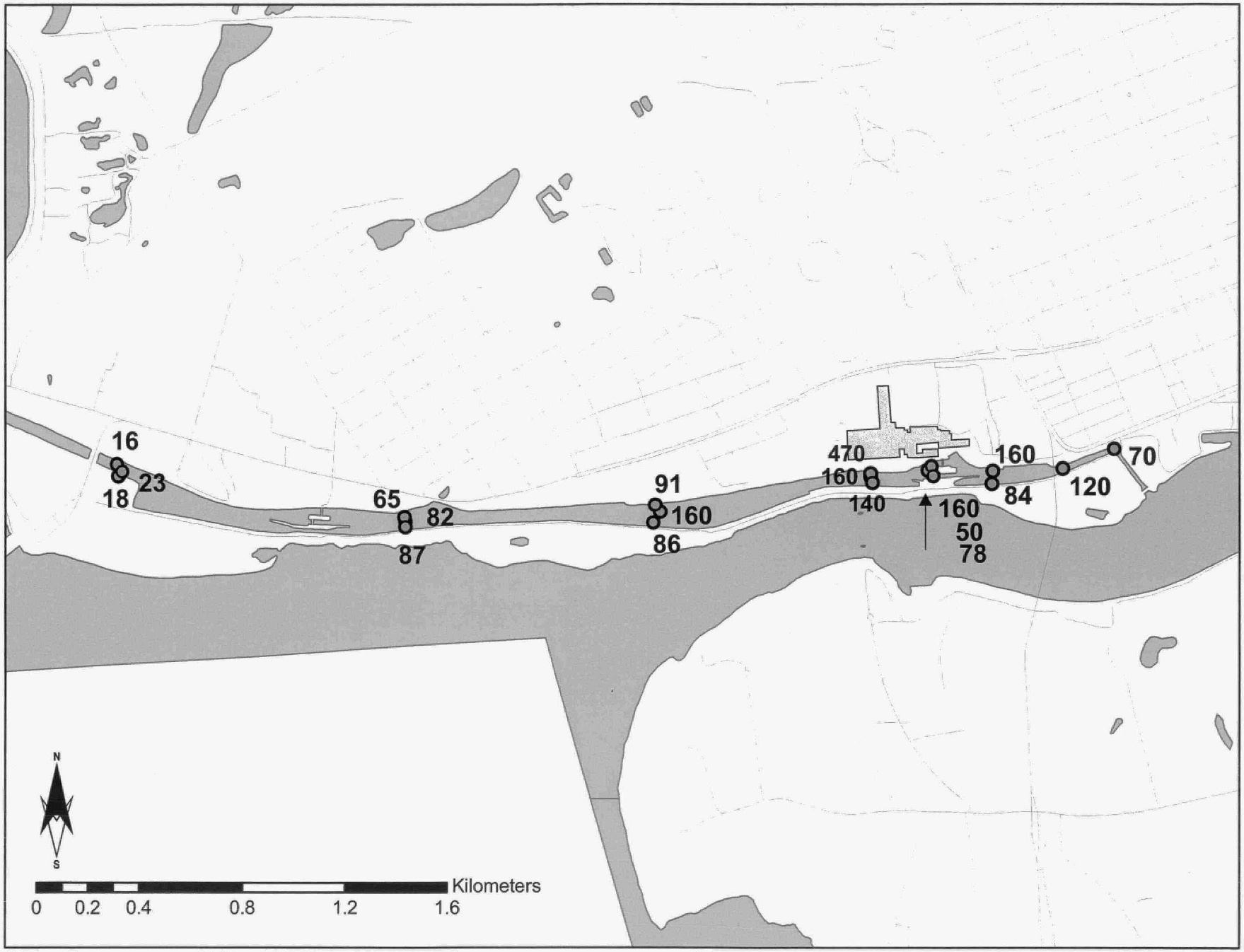
TOC concentrations in almost all sediment samples collected at, and downstream of, Transect 3, were greater than the SEL suggesting highly organic sediment (Figure 6). The highest concentration was in sediment from Transect 4 (station 539; 490 mg/g) located immediately downstream of a storm sewer which receives runoff from the surrounding area (L. Chalmers, personal communication). TOC concentrations decreased with increasing distance downstream from the outfall, as well as along Transect 4 (160 mg/g and 140 mg/g) suggesting the outfall as a possible source of the organic matter. TOC concentrations and LOI were highly correlated (r^2 =0.92). TOC was not correlated with percent silt/clay (r^2 =0.07). However, the correlation improved (r^2 =0.39) with the removal of station 539.

At Transects 1, 2, 3 and 5 only one core segment was available (maximum core length was 12 cm). A comparison of sediment surface chemistry (top 3 cm) with the core sample (0 to 6 cm) at Transect 1 showed no difference in metal concentrations (Table A1). When the data were corrected for particle size differences, concentrations of most metals where higher at the surface compared with the core sample although the increase was not large. At Transect 2 and 3 where core lengths were 0 to 9 cm and 0 to 12 cm respectively, surface samples had higher metal and TOC concentrations than the cores. TOC concentrations were two to three times higher in the surface samples. Correcting the metal concentrations for particle size reduced the differences in concentration between the surface and the core samples although Pb and Zn were still higher at the surface in Transect 3. Concentrations of metals and TOC in the surface sample from Transect 5 were similar to the concentrations in the 0 to 7 cm core with a tendency towards higher concentrations at depth for Fe, Mn and Pb. Particle size corrections did not change the patterns.

Although cores were not dated and deposition rates were unknown, a review of the data overall (with the exception of Transects 4 and 6 discussed below), suggested little change in metal concentrations with time assuming the deeper sediments represent historical conditions.

At Transect 4 (downstream of the storm sewer), the core was sectioned into two segments; 0 to 10 cm and 10 to 19 cm. Sediment chemistry within the two section were similar for all parameters and were higher than concentrations at the surface (top 3 cm) possibly suggesting historical contamination which may have come from the outfall.

Figure 6: Total Organic Carbon (mg/g) in Surface Sediment Collected From the Cornwall Canal, 2004



(Table A1) (Figure 7). Likewise, Transect 6 (station in the lower canal segment which was in the vicinity of the outfall) had higher concentrations of some metals in the core when compared with the surface sample. In this case the core segment from 0 to 10 cm and from 20 to 31 cm (bottom of the core) were analysed. Ni, Pb and Cu concentrations were highest in the 0 to 10 cm section (> SEL) while iron was highest in the 20 to 31 cm section. Zn was similar at the surface and in the 0 to 10 cm section and was greater than the 20 to 31 cm section. Particle size corrections did not alter the patterns in either Transect 4 or 6.

Sediment concentrations for aluminum, cadmium, chromium, iron and manganese in the canal were similar to concentrations present along the north shore of Cornwall Island, which historically has not been impacted by local industry (Appendix C) (Richman 1999). This suggests that there has been little contaminant enrichment in the canal over time for these metals. In general, Pb, Cu and Zn concentrations in the canal were higher at several stations than concentrations along the north shore of Cornwall Island but well below the SEL and likely not problematic for biota living in or on the sediment. TOC concentrations throughout most of the canal indicated highly organic sediment which could potentially have an effect on the local benthic community.

Total PCBs, Organochlorinated Pesticides and Chlorinated Benzenes

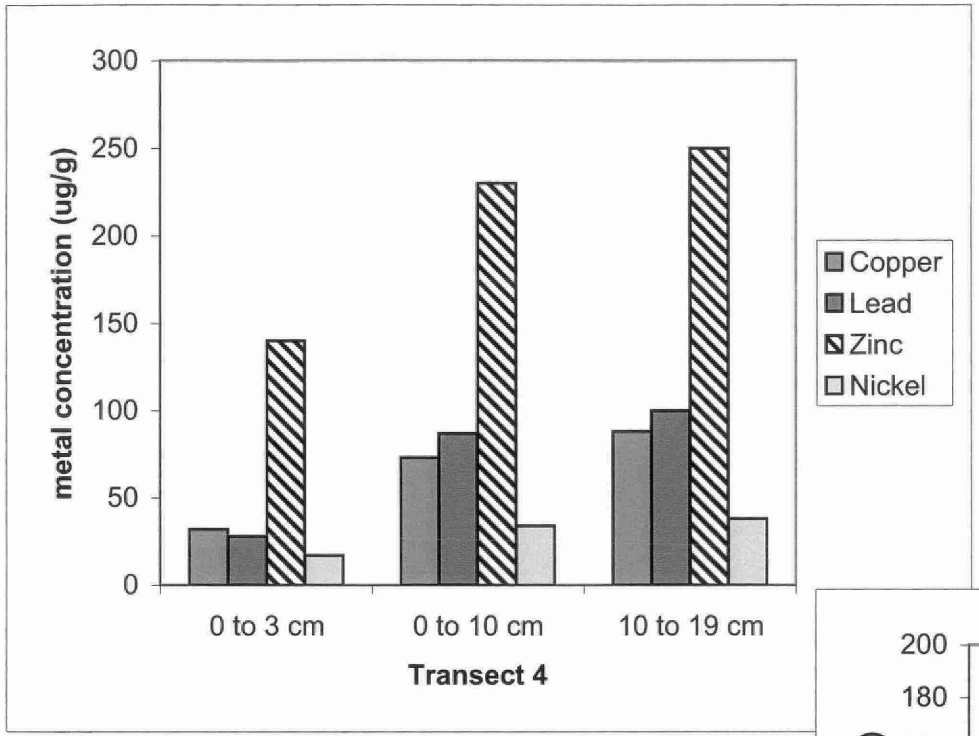
Total PCBs were present in all sediment samples with the exception of Transect 1 (Table A2). The highest concentrations were present in sediment collected from Transect 6 and 6a in the lower part of the canal. The same pattern was present when total PCB concentrations were normalized for TOC concentrations. At Transect 4, 5, and 6, surface samples had higher PCB concentrations than core samples when normalized for TOC. Concentrations increased in sediment from the west to east end of the canal.

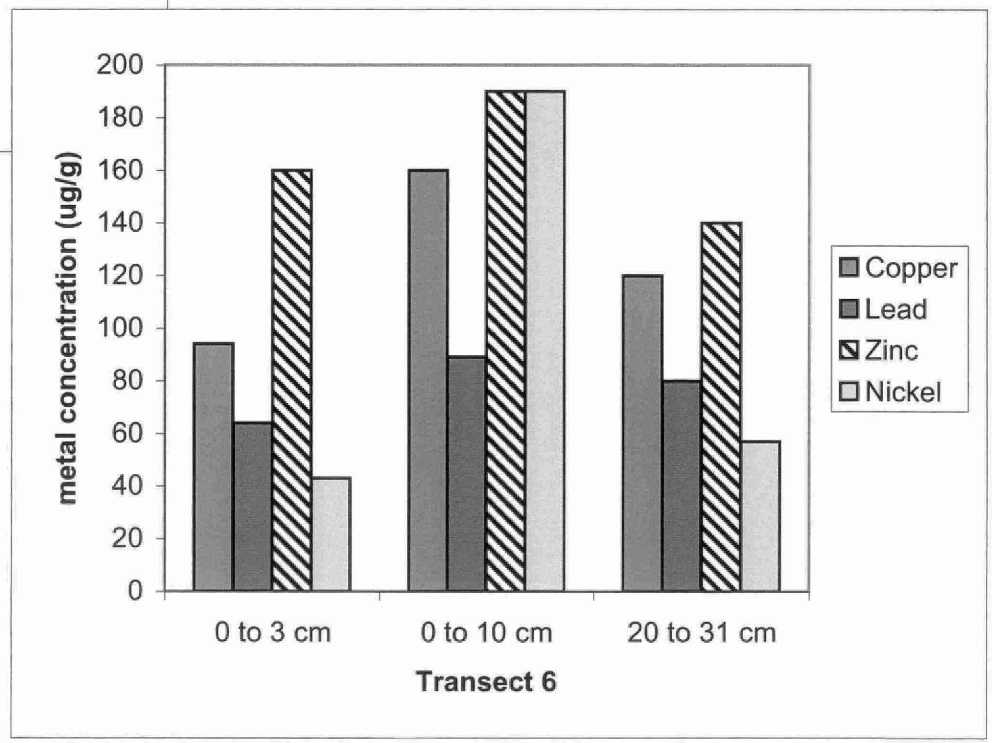
In general, with the exception of dieldrin, p,p'-DDE, 1,2,4- and 1,3,5-trichlorobenzene and pentachlorobenzene, trace concentrations of organochlorinated pesticides and chlorinated benzenes were detected only sporadically in sediment samples. Dieldrin was detected at trace concentrations in all samples collected from Transect 4 and in several samples in the lower part of the canal. The DDT metabolite, p,p'-DDE, was detected in sediment collected from all seven transects likely reflecting historical use within the area. The highest concentrations were present in Transects 4, 6 and 6a. Concentrations were similar in the surface and core samples at these three transects and ranged from 10 to 20 ng/g. Core samples collected from Transect 5, and 6 had trace and detectable concentrations of 1,2,4-trichlorobenzene and pentachlorobenzene. The bottom core sample at transect 4 also had detectable concentrations of 1,3,5 - trichlorobenzene (43 ng/g).

Polycyclic Aromatic Hydrocarbons (PAHs)

Concentrations of total PAHs in sediment were typically greater than the LEL (4 *u*g/g) at most stations with the exception of Transects 1 & 2 where concentrations were less than the LEL

Figure 7: Metal Concentrations (ng/g dry wt.) in Sufrace Sediment and Core Segments Collected From Transect 4 and 6.





(Table A3). The SEL for PAHs was not exceeded in any samples. The highest concentrations were present in the surface samples (top 3 cm) compared with the top and bottom core samples which suggested an increase in recent PAH contamination. This pattern is consistent even when data were normalized for TOC. The PAH sediment contamination begins at Transect 3. This transect is located downstream of two storm sewers which are the likely source of the high PAHs. The highest PAH concentrations in the survey were present in the surface sample collected from station 525 (151,690 ng/g) which was located on the north side of the canal close to the outfalls.

CONCLUSIONS

The methyl and total Hg sediment data suggested that the canal sediment were not highly contaminated and were, therefore, not likely to be a significant source of Hg to the St. Lawrence River. Total mercury (Hg) concentrations in surface sediment were low and typically below the LEL (0.2 ug/g) in the upper segment of the canal. Sediment in the lower segment of the canal had total Hg concentrations similar to some sites located downstream of historical Hg dischargers along the Cornwall waterfront which suggests some Hg enrichment relative to local background concentrations. However, all Hg concentrations were below the SEL. With the exception of two stations, methyl mercury concentrations in surface and core samples were similar to concentrations previously measured upstream of local industrial sources in Lake St. Lawrence (Grapentine *et al.* 2003). The north station on Transect 6 had the highest total Hg concentrations at the surface and concentrations increased with core depth. Methyl Hg was not high at the surface when compared with the other samples in the survey, but the concentrations within the core suggested increased mercury methylation with sediment depth. This station, located just downstream of an outfall which may have been associated with Domtar, also had high sediment concentrations of Ni, Cu and Fe (i.e. greater than the SEL) and high total PCB concentrations when compared to other stations in the canal.

In general, throughout the canal, sediment concentrations of TOC and metals (with the exception of Transect 1 and manganese), were above the LEL. Cu, Fe and Ni were the only metals found at concentrations greater than the SEL and this only occurred in one core sample collected from one station in Transect 6. In general, concentrations of Cu, Hg and Ni tended to be higher in the lower segment of the canal (at Transect 6 and 6A) when compared with the upper segment of the canal. This pattern was confirmed when the data were normalized for particle size differences. Pb, Cu and Zn concentrations were higher at several stations throughout the canal than concentrations along the Cornwall waterfront that were considered to represent local background conditions. Nevertheless, these values were well below the SEL and likely not problematic for biota living in or on the sediment

TOC concentrations in most sediment samples collected at, and downstream of, Transect 3, were greater than the SEL (100 mg/g) suggesting highly organic sediment which could have the potential to impact the local benthic community.

Total PCBs were present in all sediment samples with the exception of Transect 1.

Concentrations were greater than the LEL (0.07 ug/g) at most stations but did not exceed the SEL. The highest concentrations were present in sediment collected from Transect 6 and 6a in the lower part of the canal (range: 200 ng/g to 550 ng/g).

Concentrations of total PAHs in sediment were typically greater than the LEL (4 *u*g/g) at most stations. The SEL was not exceeded in any samples. The highest concentrations were present in the surface samples (top 3 cm) compared with the core samples which suggested an increase in recent PAH contamination.

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APPENDIX

TABLE A1: Concentration of metals and particle size data for sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.
Values > LEL are in bold.
Values > SEL are designated **

Transect #	Station Description	Station	Core Length	Field Sample	Water Depth (m)	Aluminum UG/G DRY		Cadmium UG/G DRY		Chromium UG/G DRY		Copper UG/G DRY	
1	West end of Canal												
	North side of canal	1200020533		GL045601	4.2	4900		0.5	<T	12		7	
	Center of Canal	1200020534		GL045603	3.3	5600		0.9	<T	16		11	
	South side of canal	1200020523		GL045602	3	4800		0.5	<T	13		9	
	South side of canal (core top)	1200020523	0 to 6 cm	GL045625	3	5800		0.3	<T	14		9	
2	Downstream of Lock (200m)												
	North side of canal	1200020524		GL045605	4.1	14000		**1.3**		**42**		**55**	
	North side of canal (core top)	1200020524	0 to 9 cm	GL045627	4.1	7700		**0.9**	<T	22		**21**	
	Center of canal	1200020535		GL045604	5.5	17000		**1.9**		**50**		**56**	
	South side of canal	1200020536		GL045606	5.9	18000		**2.1**		**53**		**61**	
3	Upstream of Fertilizer Plant (200 m)												
	North side of canal	1200020525		GL045608	4	13000		**1.9**		**39**		**62**	
	North side of canal (core top)	1200020525	0 to 12 cm	GL045629	4	8300		**0.9**	<T	24		**34**	
	Center of Canal	1200020537		GL045607	5.1	11000		**1**		**31**		**40**	
	South side of canal	1200020538		GL045609	2.6	11000		**1.5**		**33**		**53**	
4	Downstream of "Domtar" outfall (5 m)												
	North side of canal	1200020539		GL045611	3.2	6900		**1**		17		**35**	
	Center of canal	1200020526		GL045610	4.6	8500		**1.2**		22		**32**	
	Center of Canal (core top)	1200020526	0 to 10 cm	GL045631	4.6	17000		**2.2**		**49**		**73**	
	Center of Canal (core bottom)	1200020526	10 to 19 cm	GL045632	4.6	19000		**2.2**		**54**		**88**	
	South side of canal	1200020540		GL045612	6.4	13000		**2**		**38**		**56**	
5	Upstream of Domtar Door 16 (5 m)												
	North side of canal	1200020527		GL045614	5.1	12000		**1.5**		**35**		**50**	
	North side of canal (core top)	1200020527	0 to 7 cm	GL045633	5.1	9900		**0.9**	<T	**33**		**46**	
	Center of Canal	1200020541		GL045613	1.5	4000		0.2	<=W	11		9	
	South side of canal	1200020542		GL045615	2.5	6300		**0.6**	<T	18		**23**	
6	2nd part of Canal (west end of concrete platform)												
	North side of canal	1200020528		GL045616	3.6	13000		**1.1**		**40**		**94**	
	North side of canal (core top)	1200020528	0 to 10 cm	GL045635	3.6	16000		**1.3**		**42**		**160****	
	North side of canal (core bottom)	1200020528	20 to 31 cm	GL045636	3.6	17000		**1.1**		**47**		**120****	
	South side of canal	1200020543		GL045617	4.3	7500		**0.8**	<T	22		**36**	
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	GL045639	4.2	8700		**0.7**	<T	26		**71**	
7	Downstream end of Canal	1200020529		GL045619	3.8	10000		**1.1**		**29**		**56**	
Lowest Effect Level								**0.6**		**26**		**16**	
Severe Effect Level **								**10**		**110**		**110**	

<W no measurable response
<T measurable trace amount

TABLE A1: Concentration of metals and particle size data for sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.
Values > LEL are in bold.
Values > SEL are designated **

Transect #	Station Description	Station	Core Length	Iron UG/G DRY		Mercury UG/G DRY		Total Hg ng/g (dry wt.) Flett	Methyl Hg ng/g (dry wt.) Flett	Manganese UG/G DRY		Nickel UG/G DRY	
1	West end of Canal												
	North side of canal	1200020533		9700		0.01	<=W			240		8.2	
	Center of Canal	1200020534		11000		0.02	<T			200		12	
	South side of canal	1200020523		9600		0.02	<T	27.3	0.7	200		10	
	South side of canal (core top)	1200020523	0 to 6 cm	12000		0.01	<=W	192	0.4	320		11	
2	Downstream of Lock (200m)												
	North side of canal	1200020524		**20000**		0.1				280		**29**	
	North side of canal (core top)	1200020524	0 to 9 cm	12000		0.08				210		14	
	Center of canal	1200020535		**23000**		0.1				320		**34**	
	South side of canal	1200020536		**25000**		0.12				350		**38**	
3	Upstream of Fertilizer Plant (200 m)												
	North side of canal	1200020525		19000		0.15		134	0.6	310		**27**	
	North side of canal (core top)	1200020525	0 to 12 cm	13000		0.08		129	0.3	230		16	
	Center of Canal	1200020537		18000		0.08				400		**24**	
	South side of canal	1200020538		16000		0.15				260		**24**	
4	Downstream of "Domtar" outfall (5 m)												
	North side of canal	1200020539		12000		0.13				160		**18**	
	Center of canal	1200020526		11000		0.06		107	0.4	290		**17**	
	Center of Canal (core top)	1200020526	0 to 10 cm	**22000**		**0.25**		**418**	0.2	340		**34**	
	Center of Canal (core bottom)	1200020526	10 to 19 cm	**25000**		**0.28**		**314**	0.5	390		**38**	
	South side of canal	1200020540		19000		0.16				320		**28**	
5	Upstream of Domtar Door 16 (5 m)												
	North side of canal	1200020527		**21000**		0.18		**271**	0.8	280		**27**	
	North side of canal (core top)	1200020527	0 to 7 cm	**36000**		**0.21**		**1060**	0.6	430		**29**	
	Center of Canal	1200020541		7900		0.03	<T			140		7.5	
	South side of canal	1200020542		11000		0.1				180		14	
6	2nd part of Canal (west end of concrete platform)												
	North side of canal	1200020528		**21000**		**0.46**		**666**	0.7	230		**43**	
	North side of canal (core top)	1200020528	0 to 10 cm	**27000**		**0.71**		**1980**	2.3	190		**190****	
	North side of canal (core bottom)	1200020528	20 to 31 cm	**65000****		**1.2**		**429**	13	280		**57**	
	South side of canal	1200020543		14000		0.15				230		**35**	
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	18000		**0.47**		**285**	1.5	190		**35**	
7	Downstream end of Canal	1200020529		17000		**0.22**		**288**	0.8	260		**28**	
Lowest Effect Level				**2%**		**0.2**				**460**		**16**	
Severe Effect Level **				**4%**		**2**				**1100**		**75**	

<W no measurable response
<T measurable trace amount

TABLE A1: Concentration of metals and particle size data for sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.
Values > LEL are in bold.
Values > SEL are designated **

Transect #	Station Description	Station	Core Length	Lead UG/G DRY		Zinc UG/G DRY	LOI MG/G DRY	TOC MG/G DRY	Silt %	Sand %		Clay %
1	West end of Canal											
	North side of canal	1200020533		4	<T	32	14	**16**	13	75		4.3
	Center of Canal	1200020534		9	<T	45	23	**23**	25	66		7.3
	South side of canal	1200020523		2	<=W	35	17	**18**	17	72		5.4
	South side of canal (core top)	1200020523	0 to 6 cm	4	<T	28	8.1	**12**	30	57		9.9
2	Downstream of Lock (200m)											
	North side of canal	1200020524		**44**		**130**	83	**65**	67	12		21.3
	North side of canal (core top)	1200020524	0 to 9 cm	20		61	29	**30**	29	60		10.5
	Center of canal	1200020535		**40**		**150**	120	**82**	67	9		23.8
	South side of canal	1200020536		**49**		**170**	120	**87**	69	7		24.2
3	Upstream of Fertilizer Plant (200 m)											
	North side of canal	1200020525		**84**		**190**	110	**91**	52	33		14.6
	North side of canal (core top)	1200020525	0 to 12 cm	**35**		75	39	**36**	36	52		11.9
	Center of Canal	1200020537		**45**		120	180	**160****	66	14		19.4
	South side of canal	1200020538		**63**		**140**	100	**86**	63	17		19.3
4	Downstream of "Domtar" outfall (5 m)											
	North side of canal	1200020539		**40**		110	420	**470****	28	58		8.7
	Center of canal	1200020526		28		**140**	120	**160****	65	7		28.3
	Center of Canal (core top)	1200020526	0 to 10 cm	**87**		**230**	140	**130****	68	5		27
	Center of Canal (core bottom)	1200020526	10 to 19 cm	**100**		**250**	130	**130****	70	2	<T	27.7
	South side of canal	1200020540		**64**		**190**	140	**140****	66	8		26
5	Upstream of Domtar Door 16 (5 m)											
	North side of canal	1200020527		**50**		**130**	140	**160****	56	28		16.1
	North side of canal (core top)	1200020527	0 to 7 cm	**79**		96	150	**170****	47	40		13.6
	Center of Canal	1200020541		15		30	31	**50**	12	82		4.3
	South side of canal	1200020542		24		59	68	**78**	47	43		10.5
6	2nd part of Canal (west end of concrete platform)											
	North side of canal	1200020528		**64**		**160**	150	**160****	53	33		14.2
	North side of canal (core top)	1200020528	0 to 10 cm	**89**		**190**	220	**260****	56	25		19.2
	North side of canal (core bottom)	1200020528	20 to 31 cm	**80**		**140**	130	**230****	70	12		17.7
	South side of canal	1200020543		28		76	79	**84**	28	59		9.8
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	**39**		94	81	**120****	36	55		9.7
7	Downstream end of Canal	1200020529		**43**		110	86	**70**	37	52		11.1
Lowest Effect Level				**31**		**120**		**1%**				
Severe Effect Level **				**250**		**820**		**10%**				

<W no measurable response
<T measurable trace amount

TABLE A2: Concentration of organochlorinated pesticides, total PCBs and chlorinated benzenes in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station	Core length	Field Sample	Aldrin NG/G DRY		a-BHC NG/G DRY	VQF	b-BHC NG/G DRY		g-BHC NG/G DRY		a-chlordane NG/G DRY		g-chlordane NG/G DRY	
1	West end of Canal															
	North side of canal	1200020533		GL045601	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	Center of canalSouth side of canal	1200020534		GL045603	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	South side of canal	1200020523		GL045602	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	South side of canal (core top)	1200020523	0 to 6 cm	GL045625	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
2	Downstream of Lock (200m)															
	North side of canal	1200020524		GL045605	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	North side of Canal (core top)	1200020524	0 to 9 cm	GL045627	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	Center of canal	1200020535		GL045604	1	<=W	1	<=W	1	<=W	3	<T	2	<=W	2	<=W
	South side of canal	1200020536		GL045606	1	<=W	1	<=W	1	<=W	2	<T	2	<=W	2	<=W
3	Upstream of Fertilizer Plant (200 m)															
	North side of canal	1200020525		GL045608	1	<=W	3	<T	1	<=W	1	<=W	2	<=W	2	<=W
	North side of canal (core top)	1200020525	0 to 12 cm	GL045629	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	Center of Canal	1200020537		GL045607	1	<=W	1	<=W	2	<T	1	<=W	2	<=W	2	<=W
	South side of canal	1200020538		GL045609	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
4	Downstream of "Domtar" outfall (5 m)															
	North side of canal	1200020539		GL045611	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	Center of canal	1200020526		GL045610	1	<=W	2	<T	1	<=W	1	<=W	2	<=W	2	<=W
	Center of Canal (core top)	1200020526	0 to 10 cm	GL045631	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	Center of Canal (core bottom)	1200020526	10 to 19 cm	GL045632	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	South side of canal	1200020540		GL045612	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
5	Upstream of Domtar Door 16 (5 m)															
	North side of canal	1200020527		GL045614	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	North side of canal (core top)	1200020527	0 to 7 cm	GL045633	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	Center of Canal	1200020541		GL045613	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	South side of canal	1200020542		GL045615	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
6	2nd part of Canal (west end of concrete platform)															
	North side of canal	1200020528		GL045616	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
	North side of canal (core top)	1200020528	0 to 10 cm	GL045635	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	3	<T
	North side of canal (core bottom)	1200020528	20 to 31 cm	GL045636	1	<=W	3	<T	1	<=W	1	<=W	2	<=W	3	<T
	South side of canal	1200020543		GL045617	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	GL045639	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W
7	Downstream end of Canal	1200020529		GL045619	1	<=W	1	<=W	1	<=W	1	<=W	2	<=W	2	<=W

<W no measurable response
<T measurable trace amount

TABLE A2: Concentration of organochlorinated pesticides, total PCBs and chlorinated benzenes in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station	Core length	Dieldrin NG/G DRY		Methoxychlor NG/G DRY		Endosulfan I NG/G DRY		Endosulfan II NG/G DRY		Endrin NG/G DRY		Endosulfan Sulfate NG/G DRY		Heptachlor epoxide NG/G DRY		Heptachlor NG/G DRY	
1	West end of Canal																		
	North side of canal	1200020533		2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	Center of canalSouth side of canal	1200020534		2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	South side of canal	1200020523		2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	South side of canal (core top)	1200020523	0 to 6 cm	2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
2	Downstream of Lock (200m)																		
	North side of canal	1200020524		2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	2	<T	5	<T
	North side of Canal (core top)	1200020524	0 to 9 cm	2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	Center of canal	1200020535		2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	4	<T	1	<=W
	South side of canal	1200020536		2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	3	<T	4	<T
3	Upstream of Fertilizer Plant (200 m)																		
	North side of canal	1200020525		2	<=W	15	<T	4	<T	9	<T	4	<=W	4	<=W	3	<T	1	<=W
	North side of canal (core top)	1200020525	0 to 12 cm	2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	Center of Canal	1200020537		3	<T	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	South side of canal	1200020538		2	<=W	16	<T	2	<=W	4	<=W	4	<=W	4	<=W	2	<T	1	<=W
4	Downstream of "Domtar" outfall (5 m)																		
	North side of canal	1200020539		3	<T	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	2	<T	1	<=W
	Center of canal	1200020526		3	<T	5	<=W	2	<=W	5	<T	4	<=W	4	<=W	2	<T	1	<=W
	Center of Canal (core top)	1200020526	0 to 10 cm	4	<T	5	<=W	2	<=W	5	<T	4	<=W	4	<=W	1	<=W	1	<=W
	Center of Canal (core bottom)	1200020526	10 to 19 cm	3	<T	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	2	<T	1	<=W
	South side of canal	1200020540		4	<T	5	<=W	2	<=W	6	<T	4	<=W	4	<=W	1	<=W	1	<=W
5	Upstream of Domtar Door 16 (5 m)																		
	North side of canal	1200020527		3	<T	5	<=W	2	<=W	5	<T	4	<=W	4	<=W	1	<=W	1	<=W
	North side of canal (core top)	1200020527	0 to 7 cm	2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	Center of Canal	1200020541		2	<=W	5	<=W	12	<T	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	South side of canal	1200020542		2	<=W	5	<=W	3	<T	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
6	2nd part of Canal (west end of concrete platform)																		
	North side of canal	1200020528		2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	North side of canal (core top)	1200020528	0 to 10 cm	3	<T	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	North side of canal (core bottom)	1200020528	20 to 31 cm	3	<T	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
	South side of canal	1200020543		2	<=W	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	3	<T	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W
7	Downstream end of Canal	1200020529		3	<T	5	<=W	2	<=W	4	<=W	4	<=W	4	<=W	1	<=W	1	<=W

<W no measurable response
<T measurable trace amount

TABLE A2: Concentration of organochlorinated pesticides, total PCBs and chlorinated benzenes in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station	Core length	Mirex NG/G DRY		Oxychlordane NG/G DRY		o,p'-DDT NG/G DRY		Total PCB NG/G DRY		PCB normalized for TOC NG/G DRY	DDT and metabolites NG/G DRY		p,p-DDT NG/G DRY		p,p-DDE NG/G DRY	
1	West end of Canal																	
	North side of canal	1200020533		5	<=W	2	<=W	5	<=W	20	<=W	1250	2	<=W	5	<=W	2	<T
	Center of canalSouth side of canal	1200020534		5	<=W	2	<=W	5	<=W	20	<=W	870	2	<=W	5	<=W	1	<=W
	South side of canal	1200020523		5	<=W	2	<=W	5	<=W	20	<=W	1111	2	<=W	5	<=W	1	<=W
	South side of canal (core top)	1200020523	0 to 6 cm	5	<=W	2	<=W	5	<=W	20	<=W	1667	2	<=W	5	<=W	1	<=W
2	Downstream of Lock (200m)																	
	North side of canal	1200020524		5	<=W	2	<=W	5	<=W	51	P40	785	13	<T	5	<=W	5	<T
	North side of Canal (core top)	1200020524	0 to 9 cm	5	<=W	2	<=W	5	<=W	32	P40	1067	3	<T	5	<=W	3	<T
	Center of canal	1200020535		5	<=W	2	<=W	5	<=W	51	P40	622	3	<T	5	<=W	3	<T
	South side of canal	1200020536		5	<=W	2	<=W	5	<=W	49	P40	563	5	<T	5	<=W	5	<T
3	Upstream of Fertilizer Plant (200 m)																	
	North side of canal	1200020525		5	<=W	2	<=W	5	<=W	61	P40	670	14	<T	9	<T	1	<=W
	North side of canal (core top)	1200020525	0 to 12 cm	5	<=W	2	<=W	5	<=W	80	P40	2222	3	<T	5	<=W	3	<T
	Center of Canal	1200020537		5	<=W	2	<=W	5	<=W	83	P40	519	3	<T	5	<=W	3	<T
	South side of canal	1200020538		5	<=W	2	<=W	5	<=W	68	P40	791	3	<T	5	<=W	3	<T
4	Downstream of "Domtar" outfall (5 m)																	
	North side of canal	1200020539		5	<=W	2	<=W	5	<=W	210	P40	447	8	<T	5	<=W	8	<T
	Center of canal	1200020526		5	<=W	2	<=W	5	<=W	280	P40	1750	10	<T	5	<=W	10	
	Center of Canal (core top)	1200020526	0 to 10 cm	5	<=W	2	<=W	5	<=W	200	P40	1538	12	<T	5	<=W	12	
	Center of Canal (core bottom)	1200020526	10 to 19 cm	5	<=W	2	<=W	5	<=W	200	P40	1538	16	<T	6	<T	10	
	South side of canal	1200020540		5	<=W	2	<=W	5	<=W	200	P40	1429	7	<T	5	<=W	7	<T
5	Upstream of Domtar Door 16 (5 m)																	
	North side of canal	1200020527		5	<=W	2	<=W	5	<=W	160	P40	1000	6	<T	5	<=W	6	<T
	North side of canal (core top)	1200020527	0 to 7 cm	5	<=W	2	<=W	5	<=W	130	P40	765	6	<T	5	<=W	6	<T
	Center of Canal	1200020541		5	<=W	2	<=W	5	<=W	51	P40	1020	2	<=W	5	<=W	2	<T
	South side of canal	1200020542		5	<=W	2	<=W	5	<=W	42	P40	538	2	<=W	5	<=W	1	<=W
6	2nd part of Canal (west end of concrete platform)																	
	North side of canal	1200020528		5	<=W	2	<=W	5	<=W	450	P40	2813	16	<T	5	<=W	16	
	North side of canal (core top)	1200020528	0 to 10 cm	5	<=W	2	<=W	5	<=W	550	P40	2115	20		5	<=W	20	
	North side of canal (core bottom)	1200020528	20 to 31 cm	5	<=W	2	<=W	5	<=W	490	P40	2130	23		8	<T	15	
	South side of canal	1200020543		5	<=W	2	<=W	5	<=W	200	P40	2381	8	<T	5	<=W	8	<T
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	5	<=W	2	<=W	5	<=W	380	P40	3167	16	<T	5	<=W	16	
7	Downstream end of Canal	1200020529		5	<=W	2	<=W	5	<=W	210	P40	3000	7	<T	5	<=W	7	<T

<W no measurable response
<T measurable trace amount

TABLE A2: Concentration of organochlorinated pesticides, total PCBs and chlorinated benzenes in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station	Core length	p'p'-DDT NG/G DRY		Toxaphene NG/G DRY		Hexachloro-butadiene NG/G DRY		1,2,3 Tri-chlorobenzene NG/G DRY		1,2,3,4 Tetra chlorobenzene NG/G DRY		1,3,3,5 Tetra-chlorobenzene NG/G DRY		1,2,4 Tri chlorobenzene NG/G DRY		1,2,4,5 Tetra chlorobenzene NG/G DRY	
1	West end of Canal																		
	North side of canal	1200020533		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	Center of canalSouth side of canal	1200020534		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	South side of canal	1200020523		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	South side of canal (core top)	1200020523	0 to 6 cm	5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
2	Downstream of Lock (200m)																		
	North side of canal	1200020524		8	<T	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	North side of Canal (core top)	1200020524	0 to 9 cm	5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	Center of canal	1200020535		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	South side of canal	1200020536		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
3	Upstream of Fertilizer Plant (200 m)																		
	North side of canal	1200020525		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	North side of canal (core top)	1200020525	0 to 12 cm	5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	Center of Canal	1200020537		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	South side of canal	1200020538		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
4	Downstream of "Domtar" outfall (5 m)																		
	North side of canal	1200020539		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	Center of canal	1200020526		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	Center of Canal (core top)	1200020526	0 to 10 cm	5	<=W	50	<=W	1	<=W	10	<T	1	<=W	1	<=W	9	<T	4	<T
	Center of Canal (core bottom)	1200020526	10 to 19 cm	5	<=W	50	<=W	1	<=W	2	<=W	2	<T	1	<=W	11	<T	1	<=W
	South side of canal	1200020540		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
5	Upstream of Domtar Door 16 (5 m)																		
	North side of canal	1200020527		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	North side of canal (core top)	1200020527	0 to 7 cm	5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	12	<T	1	<=W
	Center of Canal	1200020541		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	South side of canal	1200020542		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
6	2nd part of Canal (west end of concrete platform)																		
	North side of canal	1200020528		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
	North side of canal (core top)	1200020528	0 to 10 cm	5	<=W	50	<=W	1	<=W	2	<=W	5	<T	1	<=W	20		1	<=W
	North side of canal (core bottom)	1200020528	20 to 31 cm	5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	16	<T	1	<=W
	South side of canal	1200020543		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	11	<T	1	<=W
7	Downstream end of Canal	1200020529		5	<=W	50	<=W	1	<=W	2	<=W	1	<=W	1	<=W	2	<=W	1	<=W

<W no measurable response
<T measurable trace amount

TABLE A2: Concentration of organochlorinated pesticides, total PCBs and chlorinated benzenes in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station	Core length	1,3,5 Tri chlorobenzene NG/G DRY		Hexachloro-benzene NG/G DRY		Hexachloro-ethane NG/G DRY		Octachloro-styrene NG/G DRY		Pentachloro-benzene NG/G DRY		2,3,6 Trichloro-toluene NG/G DRY		2,4,5 Trichloro-toluene NG/G DRY		2,6A Trichloro-toluene NG/G DRY	
1	West end of Canal																		
	North side of canal	1200020533		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	Center of canalSouth side of canal	1200020534		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	South side of canal	1200020523		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	South side of canal (core top)	1200020523	0 to 6 cm	2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
2	Downstream of Lock (200m)																		
	North side of canal	1200020524		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	North side of Canal (core top)	1200020524	0 to 9 cm	2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	Center of canal	1200020535		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	South side of canal	1200020536		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
3	Upstream of Fertilizer Plant (200 m)																		
	North side of canal	1200020525		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	North side of canal (core top)	1200020525	0 to 12 cm	2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	Center of Canal	1200020537		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	South side of canal	1200020538		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
4	Downstream of "Domtar" outfall (5 m)																		
	North side of canal	1200020539		2	<=W	3	<T	1	<=W	1	<=W	2	<T	1	<=W	1	<=W	1	<=W
	Center of canal	1200020526		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	Center of Canal (core top)	1200020526	0 to 10 cm	2	<=W	1	<=W	1	<=W	1	<=W	3	<T	1	<=W	1	<=W	1	<=W
	Center of Canal (core bottom)	1200020526	10 to 19 cm	43		1	<=W	1	<=W	1	<=W	6	<T	1	<=W	1	<=W	1	<=W
	South side of canal	1200020540		4	<T	1	<=W	1	<=W	1	<=W	2	<T	1	<=W	1	<=W	1	<=W
5	Upstream of Domtar Door 16 (5 m)																		
	North side of canal	1200020527		2	<=W	1	<=W	1	<=W	1	<=W	2	<T	1	<=W	1	<=W	1	<=W
	North side of canal (core top)	1200020527	0 to 7 cm	2	<=W	1	<=W	1	<=W	1	<=W	2	<T	1	<=W	1	<=W	1	<=W
	Center of Canal	1200020541		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	South side of canal	1200020542		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
6	2nd part of Canal (west end of concrete platform)																		
	North side of canal	1200020528		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
	North side of canal (core top)	1200020528	0 to 10 cm	2	<=W	1	<=W	1	<=W	1	<=W	2	<T	1	<=W	1	<=W	1	<=W
	North side of canal (core bottom)	1200020528	20 to 31 cm	2	<=W	1	<=W	1	<=W	1	<=W	2	<T	1	<=W	1	<=W	1	<=W
	South side of canal	1200020543		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W
7	Downstream end of Canal	1200020529		2	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W	1	<=W

<W no measurable response
<T measurable trace amount

TABLE A3: Concentration of polycyclic aromatic hydrocarbons in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station number	Core Length	Field Sample number	Acenaphthene ng/g (dry wt.)	RMK	Acenaphthylene ng/g (dry wt.)	RMK	Anthracene ng/g (dry wt.)	RMK	Benzo(a) anthracene ng/g (dry wt.)	RMK
1	West end of Canal											
	North side of canal	1200020533		GL045601		<=W		<=W	3	<T	11	<T
	Center of canal	1200020534		GL045603		<=W		<=W	3.2	<T	9	<T
	South side of canal	1200020523		GL045602		<=W		<=W	2.7	<T	9	<T
	South side of canal (core top)	1200020523	0 to 6 cm	GL045625		<=W		<=W		<=W	3	<T
2	Downstream of Lock (200m)											
	Center of canal	1200020535		GL045604	9	<T	17	<T	23		93	
	North side of canal	1200020524		GL045605	5	<T	19	<T	20		79	
	North side of canal (core top)	1200020524	0 to 9 cm	GL045627	15	<T	5	<T	24		48	
	South side of canal	1200020536		GL045606	8	<T	15	<T	24		100	
3	Upstream of Fertilizer Plant (200 m)											
	North side of canal	1200020525		GL045608	660		790		2200		6200	
	North side of canal (core top)	1200020525	0 to 12 cm	GL045629	15	<T	11	<T	28		95	
	Center of Canal	1200020537		GL045607	56		29		120		700	
	South side of canal	1200020538		GL045609	140		21		300		860	
4	Downstream of "Domtar" outfall (5 m)											
	North side of canal	1200020539		GL045611	790		120		2000		2500	
	Center of canal	1200020526		GL045610	370		140		900		3000	
	Center of Canal (core top)	1200020526	0 to 10 cm	GL045631	110		44		250		810	
	Center of Canal (core bottom)	1200020526	10 to 19 cm	GL045632	86		91		180		460	
	South side of canal	1200020540		GL045612	230		160		560		1800	
5	Upstream of Domtar Door 16 (5 m)											
	North side of canal	1200020527		GL045614	110		130		240		810	
	North side of canal (core top)	1200020527	0 to 7 cm	GL045633	89		59		130		340	
	Center of Canal	1200020541		GL045613	67		11	<T	35		69	
	South side of canal	1200020542		GL045615	27		24		52		170	
6	2nd part of Canal (west end of concrete platform)											
	North side of canal	1200020528		GL045616	110		56		250		660	
	North side of canal (core top)	1200020528	0 to 10 cm	GL045635	220		150		230		480	
	North side of canal (core bottom)	1200020528	20 to 31 cm	GL045636	150		73		190		520	
	South side of canal	1200020543		GL045617	58		60		150		300	
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	GL045639	340		160		370		820	
7	Downstream end of Canal	1200020529		GL045619	190		37		210		390	

<W no measurable response
<T measurable trace amount

TABLE A3: Concentration of polycyclic aromatic hydrocarbons in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station number	Core Length	Benzo(a) pyrene ng/g (dry wt.)	RMK	Benzo(b) fluoranthene ng/g (dry wt.)	RMK	Benzo(e) pyrene ng/g (dry wt.)	RMK	Benzo(k) fluoranthene ng/g (dry wt.)	RMK	Chrysene ng/g (dry wt.)	RMK	Dibenzo(ah) anthracene ng/g (dry wt.)	RMK
1	West end of Canal														
	North side of canal	1200020533		9	<T	18	<T	10	<T	7	<T	15	<T	3	<T
	Center of canal	1200020534		9	<T	23		12	<T	8	<T	16	<T	5	<T
	South side of canal	1200020523		7.4	<T	19	<T	9.5	<T	6.7	<T	13	<T	4.2	<T
	South side of canal (core top)	1200020523	0 to 6 cm		<=W	6	<T	3	<T		<=W	6	<T		<=W
2	Downstream of Lock (200m)														
	Center of canal	1200020535		120		230		140		91		230		27	
	North side of canal	1200020524		94		200		110		75		150		25	
	North side of canal (core top)	1200020524	0 to 9 cm	44		85		50		33		76		9	<T
	South side of canal	1200020536		140		280		160		110		220		26	
3	Upstream of Fertilizer Plant (200 m)														
	North side of canal	1200020525		6400		13000		6600		5000		15000		840	
	North side of canal (core top)	1200020525	0 to 12 cm	100		190		110		77		170		21	
	Center of Canal	1200020537		1000		1700		960		730		1300		170	
	South side of canal	1200020538		1000		1500		870		640		1200		160	
4	Downstream of "Domtar" outfall (5 m)														
	North side of canal	1200020539		2400		3100		1700		1400		3400		350	
	Center of canal	1200020526		3200		4700		2500		2100		4500		540	
	Center of Canal (core top)	1200020526	0 to 10 cm	860		1500		860		600		1400		150	
	Center of Canal (core bottom)	1200020526	10 to 19 cm	450		850		540		330		960		89	
	South side of canal	1200020540		2200		2800		2000		1100		2700		350	
5	Upstream of Domtar Door 16 (5 m)														
	North side of canal	1200020527		810		1200		760		540		1200		160	
	North side of canal (core top)	1200020527	0 to 7 cm	320		540		320		220		600		56	
	Center of Canal	1200020541		54		98		73		35		140		11	<T
	South side of canal	1200020542		180		290		170		120		280		29	
6	2nd part of Canal (west end of concrete platform)														
	North side of canal	1200020528		740		1100		810		480		1100		140	
	North side of canal (core top)	1200020528	0 to 10 cm	470		650		700		250		860		110	
	North side of canal (core bottom)	1200020528	20 to 31 cm	530		750		730		340		940		170	
	South side of canal	1200020543		320		490		320		200		510		58	
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	790		1100		700		460		1300		130	
7	Downstream end of Canal	1200020529		400		630		370		270		600		69	

<W no measurable response
<T measurable trace amount

TABLE A3: Concentration of polycyclic aromatic hydrocarbons in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station number	Core Length	Fluoranthene ng/g (dry wt.)	RMK	Fluorene ng/g (dry wt.)	RMK	Benzo(g,h,I) perylene ng/g (dry wt.)	RMK	Indeno(1,2,3-cd) pyrene ng/g (dry wt.)	RMK	Naphthalene ng/g (dry wt.)	RMK	Perylene ng/g (dry wt.)	RMK
1	West end of Canal														
	North side of canal	1200020533		25		4	<T	9	<T	8	<T	10	<T	15	<T
	Center of canal	1200020534		24		3.8	<T	12	<T	12	<T	16	<T	35	
	South side of canal	1200020523		24		5.3	<T	11	<T	8.4	<T	12	<T	20	
	South side of canal (core top)	1200020523	0 to 6 cm	9	<T	7	<T	3	<T	3	<T	8	<T	13	<T
2	Downstream of Lock (200m)														
	Center of canal	1200020535		250		20		130		140		53		200	
	North side of canal	1200020524		200		19	<T	93		110		68		210	
	North side of canal (core top)	1200020524	0 to 9 cm	150		29		39		50		67		94	
	South side of canal	1200020536		300		22		150		160		52		220	
3	Upstream of Fertilizer Plant (200 m)														
	North side of canal	1200020525		30000		1800		4300		4400		1400		1100	
	North side of canal (core top)	1200020525	0 to 12 cm	260		36		90		110		190		100	
	Center of Canal	1200020537		2200		100		960		990		430		350	
	South side of canal	1200020538		2400		160		810		910		170		370	
4	Downstream of "Domtar" outfall (5 m)														
	North side of canal	1200020539		6600		1200		1500		1600		6900		660	
	Center of canal	1200020526		6900		570		2700		3000		1800		930	
	Center of Canal (core top)	1200020526	0 to 10 cm	1900		300		710		910		2000		370	
	Center of Canal (core bottom)	1200020526	10 to 19 cm	1100		350		370		460		3400		260	
	South side of canal	1200020540		4100		450		1600		1700		3400		620	
5	Upstream of Domtar Door 16 (5 m)														
	North side of canal	1200020527		1800		280		610		720		3600		300	
	North side of canal (core top)	1200020527	0 to 7 cm	810		250		230		290		2300		120	
	Center of Canal	1200020541		190		100		45		48		190		28	
	South side of canal	1200020542		350		82		120		160		470		90	
6	2nd part of Canal (west end of concrete platform)														
	North side of canal	1200020528		1500		230		700		790		780		260	
	North side of canal (core top)	1200020528	0 to 10 cm	1100		510		340		410		1500		210	
	North side of canal (core bottom)	1200020528	20 to 31 cm	1000		330		470		650		1800		210	
	South side of canal	1200020543		790		140		250		320		490		99	
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	2200		490		480		630		860		270	
7	Downstream end of Canal	1200020529		1100		320		300		380		860		130	

<W no measurable response
<T measurable trace amount

TABLE A3: Concentration of polycyclic aromatic hydrocarbons in sediment collected from the Cornwall Canal, 2004.
All data represent surface samples (0-3 cm) unless noted as a core sample.

Transect #	Station Description	Station number	Core Length	Phenanthrene ng/g (dry wt.)	RMK	Pyrene ng/g (dry wt.)	RMK	Total PAHs ng/g (dry wt.)	PAH normalized for TOC	SEL ug/g org carbon
1	West end of Canal									
	North side of canal	1200020533		18	<T	18	<T	158	9875	160
	Center of canal	1200020534		20		17	<T	178	7739	230
	South side of canal	1200020523		21		16	<T	160	8872	180
	South side of canal (core top)	1200020523	0 to 6 cm	8	<T	7	<T	60	5000	120
2	Downstream of Lock (200m)									
	Center of canal	1200020535		120		190		1743	21256	820
	North side of canal	1200020524		100		160		1417	21800	650
	North side of canal (core top)	1200020524	0 to 9 cm	100		120		894	29800	300
	South side of canal	1200020536		130		240		1977	22724	870
3	Upstream of Fertilizer Plant (200 m)									
	North side of canal	1200020525		25000		27000		**143990**	1582308	910
	North side of canal (core top)	1200020525	0 to 12 cm	160		230		1783	49528	360
	Center of Canal	1200020537		790		1800		**13075**	81719	1600
	South side of canal	1200020538		1300		1900		**13471**	156640	860
4	Downstream of "Domtar" outfall (5 m)									
	North side of canal	1200020539		6800		5400		**46060**	98000	4700
	Center of canal	1200020526		4200		5900		**44520**	278250	1000
	Center of Canal (core top)	1200020526	0 to 10 cm	1600		1700		**14844**	114185	1000
	Center of Canal (core bottom)	1200020526	10 to 19 cm	1600		1000		**11776**	90585	1000
	South side of canal	1200020540		2800		3600		**29550**	211071	1000
5	Upstream of Domtar Door 16 (5 m)									
	North side of canal	1200020527		1500		1500		**15210**	95063	1000
	North side of canal (core top)	1200020527	0 to 7 cm	1000		740		**7974**	46906	1000
	Center of Canal	1200020541		300		170		1563	31260	500
	South side of canal	1200020542		340		320		3014	38641	780
6	2nd part of Canal (west end of concrete platform)									
	North side of canal	1200020528		1300		1300		**11236**	70225	1000
	North side of canal (core top)	1200020528	0 to 10 cm	1600		980		**9860**	37923	1000
	North side of canal (core bottom)	1200020528	20 to 31 cm	1400		990		**10303**	44796	1000
	South side of canal	1200020543		710		730		**5576**	66381	840
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	2300		1900		**14330**	119417	1000
7	Downstream end of Canal	1200020529		1100		830		**7686**	109800	700

<W no measurable response
<T measurable trace amount

APPENDIX B: Sediment metal concentrations normalized for particle size differences. All data adjusted to reflect a particle size of 67% silt/clay which is the median for the survey area. Cornwall Canal, 2004

Transect #	Station Description	Station	Core Length	Field Sample	% Silt+Clay for each sample	Aluminum (corrected)	Cadmium (corrected)	Chromium (corrected)	Copper (corrected)
1	West end of Canal								
	North side of canal	1200020533		GL045601	17.3	18977	2	46	27
	Center of Canal	1200020534		GL045603	32.3	11616	2	33	23
	South side of canal	1200020523		GL045602	22.4	14357	1	39	27
	South side of canal (core top)	1200020523	0 to 6 cm	GL045625	39.9	9739	1	24	15
2	Downstream of Lock (200m)								
	North side of canal	1200020535		GL045604	90.8	12544	1	37	41
	North side of canal (core top)	1200020524		GL045605	88.3	10623	1	32	42
	Center of canal	1200020524	0 to 9 cm	GL045627	39.5	13061	2	37	36
	South side of canal	1200020536		GL045606	93.2	12940	2	38	44
3	Upstream of Fertilizer Plant (200 m)								
	North side of canal	1200020525		GL045608	66.6	13078	2	39	62
	North side of canal (core top)	1200020525	0 to 12 cm	GL045629	47.9	11610	1	34	48
	Center of Canal	1200020537		GL045607	85.4	8630	1	24	31
	South side of canal	1200020538		GL045609	82.3	8955	1	27	43
4	Downstream of "Domtar" outfall (5 m)								
	North side of canal	1200020539		GL045611	36.7	12597	2	31	64
	Center of canal	1200020526		GL045610	93.3	6104	1	16	23
	Center of Canal (core top)	1200020526	0 to 10 cm	GL045631	95	11989	2	35	51
	Center of Canal (core bottom)	1200020526	10 to 19 cm	GL045632	97.7	13030	2	37	60
	South side of canal	1200020540		GL045612	92	9467	1	28	41
5	Upstream of Domtar Door 16 (5 m)								
	North side of canal	1200020527		GL045614	72.1	11151	1	33	46
	North side of canal (core top)	1200020527	0 to 7 cm	GL045633	60.6	10946	1	36	51
	Center of Canal	1200020541		GL045613	16.3	16442	1	45	37
	South side of canal	1200020542		GL045615	57.5	7341	1	21	27
6	2nd part of Canal (west end of concrete platform)								
	North side of canal	1200020528		GL045616	67.2	12961	1	40	94
	North side of canal (core top)	1200020528	0 to 10 cm	GL045635	75.2	14255	1	37	143
	North side of canal (core bottom)	1200020528	20 to 31 cm	GL045636	87.7	12987	1	36	92
	South side of canal	1200020543		GL045617	37.8	13294	1	39	64
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	GL045639	45.7	12755	1	38	104
7	Downstream end of Canal	1200020529		GL045619	48.1	13929	2	40	78

APPENDIX B: Sediment metal concentrations normalized for particle size differences. All data adjusted to reflect a particle size of 67% silt/clay which is the median for the survey area. Cornwall Canal, 2004

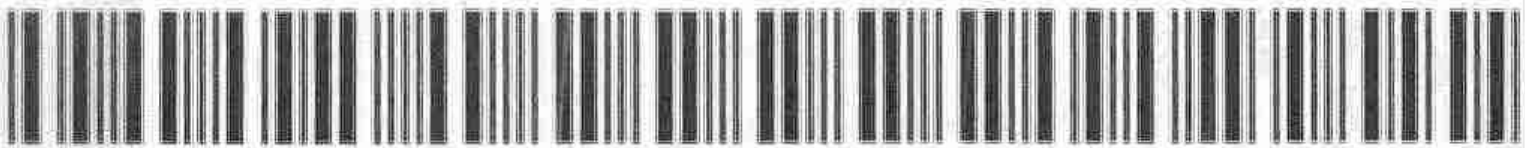
Transect #	Station Description	Station	Core Length	Iron (corrected)	Mercury (corrected)	Manganese (corrected)	Nickel (corrected)	Lead (corrected)	Zinc (corrected)
1	West end of Canal								
	North side of canal	1200020533		37566	0.04	929	32	15	124
	Center of Canal	1200020534		22817	0.04	415	25	19	93
	South side of canal	1200020523		28714	0.06	598	30	6	105
	South side of canal (core top)	1200020523	0 to 6 cm	20150	0.02	537	18	7	47
2	Downstream of Lock (200m)								
	North side of canal	1200020535		16971	0.07	236	25	30	111
	North side of canal (core top)	1200020524		15176	0.08	212	22	33	99
	Center of canal	1200020524	0 to 9 cm	20354	0.14	356	24	34	103
	South side of canal	1200020536		17972	0.09	252	27	35	122
3	Upstream of Fertilizer Plant (200 m)								
	North side of canal	1200020525		19114	0.15	312	27	85	191
	North side of canal (core top)	1200020525	0 to 12 cm	18184	0.11	322	22	49	105
	Center of Canal	1200020537		14122	0.06	314	19	35	94
	South side of canal	1200020538		13026	0.12	212	20	51	114
4	Downstream of "Domtar" outfall (5 m)								
	North side of canal	1200020539		21907	0.24	292	33	73	201
	Center of canal	1200020526		7899	0.04	208	12	20	101
	Center of Canal (core top)	1200020526	0 to 10 cm	15516	0.18	240	24	61	162
	Center of Canal (core bottom)	1200020526	10 to 19 cm	17144	0.19	267	26	69	171
	South side of canal	1200020540		13837	0.12	233	20	47	138
5	Upstream of Domtar Door 16 (5 m)								
	North side of canal	1200020527		19515	0.17	260	25	46	121
	North side of canal (core top)	1200020527	0 to 7 cm	39802	0.23	475	32	87	106
	Center of Canal	1200020541		32472	0.12	575	31	62	123
	South side of canal	1200020542		12817	0.12	210	16	28	69
6	2nd part of Canal (west end of concrete platform)								
	North side of canal	1200020528		20938	0.46	229	43	64	160
	North side of canal (core top)	1200020528	0 to 10 cm	24056	0.63	169	169	79	169
	North side of canal (core bottom)	1200020528	20 to 31 cm	49658	0.92	214	44	61	107
	South side of canal	1200020543		24815	0.27	408	62	50	135
6A	Under Bridge to USA (core top)	1200020530	0 to 7 cm	26389	0.69	279	51	57	138
7	Downstream end of Canal	1200020529		23680	0.31	362	39	60	153

APPENDIX C: Median metal, total phosphorus and TOC concentrations (µg/g dry weight) in sediment samples (top 10 cm core sample and 3 cm surface samples) collected from the St. Lawrence River, 1997.

Parameters	Median, Minimum and Maximum Concentrations of Contaminants in Sediment											
	Cornwall waterfront (downstream of industrial discharges)						North Shore of Cornwall Island					
	Surface (3 cm)	min	max	Core (10 cm)	min	max	Surface (3 cm)	min	max	Core (10 cm)	min	max
Aluminum	**14800**	10300	23400	**16800**	9630	31200	**23700**	21700	27500	**28600**	24300	33300
Cadmium	**0.758**	0.359	1.120	**0.888**	0.473	1.450	**0.990**	0.916	1.100	**1.020**	0.901	1.210
Chromium	**32.0**	25.1	49.1	**37.5**	23.8	58.8	**42.7**	39.7	48.7	**50.6**	43.8	59.1
Copper	**37.6**	19.3	57.6	**42.5**	16.9	60.9	**33.7**	30.6	41.5	**38.9**	31.8	46.3
Iron	**15900**	13100	22200	**17300**	12700	26600	**22950**	20800	26200	**26500**	23500	30000
Mercury	**1.63**	0.70	14.70	**3.06**	0.44	19.50	**0.13**	0.12	0.15	**0.13**	0.08	0.15
Manganese	**293**	222	357	**292**	201	439	**479**	386	665	**489**	435	592
Nickel	**24.9**	14.5	30.2	**24.0**	13.8	34.1	**33.0**	28.4	38.4	**30.8**	28.4	35.4
Total Phosphorus	**852**	653	1020	**745**	457	1150	**971**	698	1110	**1090**	996	1180
Lead	**33.7**	19.7	156.0	**44.0**	25.2	136.0	**26.8**	26.3	29.5	**35.2**	27.2	39.3
Zinc	**133**	69	673	**186**	102	759	**118**	110	136	**136**	117	156
TOC (%)	**2.370**	1.753	3.491	**2.516**	1.681	4.037	**2.953**	2.528	3.229	**2.532**	2.030	3.130

(Richman, 1997)

DATE DUE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